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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/609,282

06/26/2003

Yongjun Jeff Hu

MI22-2266

8289

21567

7590

10/13/2004

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EXAMINER

GURLEY, LYNNE ANN

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 10/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/609,282

Applicant(s)

HU, YONGJUN JEFF

Examiner

Lynne A. Gurley

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-58 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.


LYNNE A. GURLEY

PRIMARY PATENT EXAMINER
TC 2800, AU 2812

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6/26/03.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This office action is in response to the election without traverse, filed 7/1/04.

Currently, claims 1-58 are pending. Claims 59-81 have been canceled.

Election/Restrictions

1. Applicant's election without traverse of claims 1-58 in the reply filed on 7/1/04 is acknowledged.
2. Claims 59-81 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 7/1/04. Additionally, it has been made of record that Applicant has **canceled** the non-elected claims 59-81 in the response filed 7/1/04.

Information Disclosure Statement

3. The information disclosure statement (IDS) was submitted on 6/26/03. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Specification

4. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

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Claim Objections

5. Claims 1 and 45 are objected to because of the following informalities: In line 5 of claim 1, "comprise" should be "comprising". In line 1 of claim 45, "silicide" should be "silicide". Appropriate correction is required. Applicant's cooperation is requested in reviewing the claims for any additional discrepancies.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 1-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paek et al. (US 6,774,023, dated 8/10/04, filed 5/28/93) in view of Nakamura (JP 57194548, published 11/30/82).

Paek shows the method substantially as claimed in the abstract, and figures 1-2 and corresponding text, with emphasis on figures 3A-3B with a first refractory metal silicide 17 on a

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substrate 14 having a high melting point (column 3, column 4, lines 15-33 and 59-67; column 5, lines 1-10) and being metal enriched ($x=2$; column 3, lines 28-45), the first metal silicide layer having a thickness of at least about 50 Angstroms (column 4, lines 5-8) and comprising a predominant metal; forming a second metal silicide layer 18 over the first metal silicide layer, the second metal silicide layer having a bulk resistance of less than 30 micro-ohms-centimeter (figure 4). The first metal layer can be Ta, Mo, or W (column 4, lines 59-65). The metal of the second silicide is predominately different than the predominant metal of the first metal silicide. The metal-containing layer of the second metal silicide is Ti (column 4, lines 5-6). Thicknesses are given (column 4, lines 1-15). The substrate is silicon and has a polysilicon layer on top. The first metal silicide layer is formed directly against the silicon of the substrate (i.e. the silicon incorporated in the polysilicon layer, which is part of the substrate). Time and temperature for conventional silicide formation is given (column 3, lines 28-44). Memory devices are disclosed as benefiting from the process (column 1, lines 1-27).

Paek lacks anticipation only in not explicitly teaching that: 1) a metal-containing layer is directly formed against the first metal silicide layer; and after forming the metal-containing layer directly against the first metal silicide layer, converting the metal of the metal-containing layer to metal silicide to convert the metal-containing layer to a second metal silicide layer over the substrate; 2) the second metal silicide layer is incorporated into a bitline of an IC or, a wordline of an IC, with associated width; 3) forming a silicon nitride cap over the layer consisting essentially of silicon or conductively-doped silicon during the converting.

Nakamura teaches a method of forming a refractory metal silicide layer which prevents oxidation of the metal film prior to the formation of the silicide by depositing the refractory

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metal and then depositing a polysilicon layer (abstract; 300 Angstroms or greater depending on the thickness of the second refractory metal layer) on the refractory metal and then annealing to form the silicide. Temperatures in excess of 800 degrees C are disclosed for the silicide formation.

It would have been obvious to one of ordinary skill in the art to have formed the second metal silicide layer, in the method of Paek, by depositing the refractory metal layer capped with a polysilicon layer, as taught in the method of Nakamura, with the motivation that the formation of the second silicide by this method would prevent the oxidation of the refractory metal film prior to the silicide formation, thus making a more reliable silicide structure and silicon from the overlying layer would be incorporated into the second silicide layer at least. Additionally, the amount of silicon consumed from the substrate and underlying layers will be decreased, depending on the application of the silicide layer. The combination of the methods of Paek and Nakamura is additionally strengthened by considering the first embodiment of Paek where the second metal of the second silicide layer is directly placed on the first metal of the first silicide layer before both metal layers are annealed to form a dual silicide layer. This implies that there would be no reservation of forming the second metal layer directly on the first silicide layer. Additionally, it would have been obvious to one of ordinary skill in the art to have formed a silicon nitride cap over the layer consisting essentially of silicon or conductively-doped silicon during the converting for further protection of the layers against oxidation, since silicon nitride is often used as moisture impervious capping layer.

It would have been obvious to one of ordinary skill in the art to have incorporated the second metal silicide layer into a bitline of an IC or, a wordline of an IC, with associated width,

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in the method of Paek as modified by Nakamura, with the motivation that the bitline and wordline formation often incorporates silicide formation as a means of reliable and low resistance performance (Paek, column 1, lines 1-26).

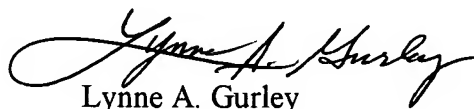
Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Please see the PTO Form 892 for very pertinent prior art regarding the formation of the silicide.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lynne A. Gurley
Primary Patent Examiner
TC 2800, Art Unit 2812

LAG
September 29, 2004